



INSTITUTE FOR DEFENSE ANALYSES

**Generic Unclassified Stockpile
Sizing Module (SSM)
Training and Testing for the
National Defense Stockpile (NDS) 2015**

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November 2014

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Executive Summary

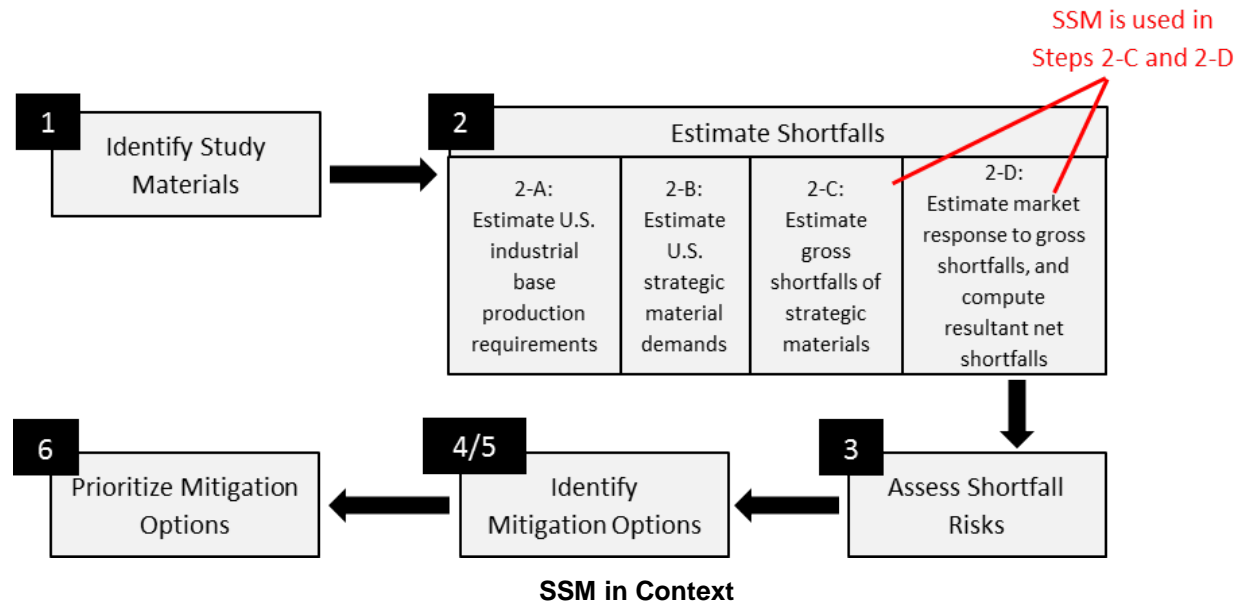
The Stockpile Sizing Module (SSM) is a modeling tool used to estimate U.S. shortfalls of strategic and critical materials (S&CM) during a national emergency scenario. This annotated briefing is intended to train a new user on the basic operation of SSM. It is designed to be used in conjunction with a training version of SSM available on compact disc (CD) from the Institute for Defense Analyses (IDA) Control and Distribution Department.

SSM Background

Understanding the context in which SSM is used is a prerequisite for effective operation. SSM is a subcomponent of a larger modeling and decision support process, the Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM). RAMF-SM is designed to identify potential shortfalls of S&CM in a national emergency scenario, assess market responses to those shortfalls, identify risks and consequences of not addressing any remaining shortfalls, and design and compare stockpiling and other government strategies to mitigate risks stemming from these shortfalls. RAMF-SM is a six-part process, and SSM is used in Steps 2-C and 2-D of RAMF-SM (see the figure on the next page). Step 2-D is a recent addition to the RAMF-SM process and simulates a market response to the initial “Gross Shortfalls.” In Step 2-D, SSM is used to estimate “Net Shortfalls,” shortfalls that remain after the simulated market response occurs. Many *inputs* to SSM are the result of previous modeling and simulation efforts, and SSM *output* is used later in RAMF-SM to assess risks and identify mitigation options.

SSM Model Logic

SSM inputs are organized into three categories: material supplies, supply adjustments, and material demands. A gross material shortfall occurs if $(\text{Supply} - \text{Adjustments}) < \text{Demand}$. Material supply defines how much of each material is available from domestic



and foreign sources. This information is provided by the U.S. Geological Survey (USGS) and other relevant sources. Domestic and foreign supply can be computed on the basis of estimated future (i.e., during the scenario period) production, estimated future production capacity, or some quantity in between. SSM combines domestic and foreign supply information to compute the total supply of each material for each year of a given national emergency scenario, which typically lasts 4 years, in accordance with Congressional guidance in the Strategic and Critical Materials Stock Piling Act.

SSM uses adjustment factors to decrement material supply. Adjustments decreasing supplies available to the United States include anti-American political sentiment of supplier countries; ability degradation of supplier countries (e.g., poor infrastructure); shipping losses due to enemy action; market competition from other countries demanding materials; and war damage to material production facilities. A supply political reliability code designates whether material supplies from a particular country can be used to satisfy U.S. defense and civilian needs, only civilian needs, or not at all. Much of this information is classified and is based on

Intelligence Community input or Defense Planning Scenarios developed by the Office of the Under Secretary of Defense for Policy (OUSD(P)). SSM applies these adjustments to derive estimates of *available* material supplies.

U.S. material demand is disaggregated into three “tiers”—defense, essential civilian, and emergency investment—for each material and each year of the scenario. Material demand is computed in previous stages (Steps 2-A and 2-B) of RAMF-SM and is based on U.S. industrial base production requirements during the specified emergency scenario. SSM compares (Supply – Adjustments) to Demand, and identifies shortfalls by year, material, and tier of demand. SSM is time-phased, and a surplus in a later year cannot offset a shortfall in an earlier year.

SSM Operation

SSM is run via an .exe program. This executable uses control input files, which define the directories and data input files. Some of the input files are in uncommon formats, but most are tab-delimited text files that can be opened and edited in Excel or Notepad. SSM is designed to run on Windows and is not memory or run-time intensive.

The first control input file is characterized by the extension .sbf and specifies the SSM output directory, default case directory, and a list of one or more Case Files for SSM to run. The Case File (recognizable by its .cas extension) is the second control input file and performs two major roles. It allows the user to specify basic scenario parameters (e.g., number of years in the scenario) and the data input files that SSM should use for this case.

Data input files include lists of countries and materials to analyze, basic material information, U.S. material supply, foreign material supply, the aforementioned adjustment factors (each of which has its own file), and more. SSM uses these data files to perform the calculations described in the Model Logic section. SSM output consists of a variety of reports concerning material supply, demand, and shortfalls.

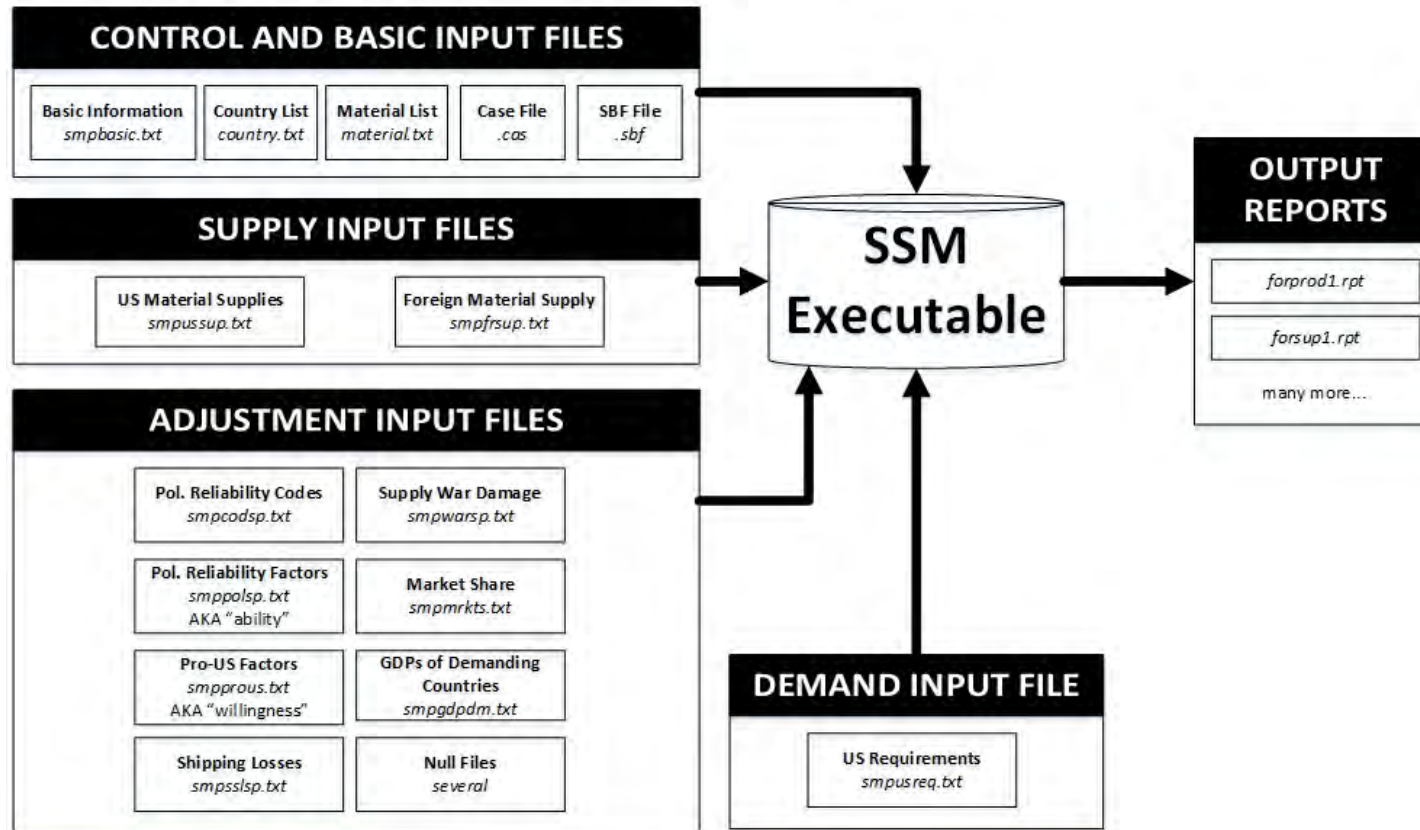
Many of these files can contain proprietary and/or classified information, but the training version of SSM provided with this briefing contains only notional data, allowing for the operation and testing of SSM in an unclassified environment. More detailed information on SSM operation can be found in IDA Paper P-2867 and draft Paper P-4442.

The figure on the next page presents SSM inputs and outputs in graphical form.

SSM MODEL LOGIC

Supply – Adjustments > US Demand?

(Broken Down by Year, Material, and Tier of Demand)



SSM Model Logic

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Generic Unclassified SSM Training and Testing for the NDS 2015

Generic Unclassified SSM Training and Testing for the NDS 2015

November 12, 2014

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1. Introduction

An earlier version of this document was briefed to Defense Logistics Agency (DLA) representatives at the Institute for Defense Analyses (IDA) facilities on July 9, 2014. It was expanded in August 2014, with annotations and additional information.

IDA | SSM Background

The Stockpile Sizing Module (SSM) is the culminating modeling component in Step 2 of the Risk Assessment and Mitigation Framework for Strategic Materials (RAMF-SM) and results in a prediction of material shortfalls based upon a large number of inputs associated with the supply and demand for strategic and critical materials (S&CM).

This briefing provides an overview of the control and input files that are necessary to run SSM and is only intended to be an overview since detailed discussions are already available via the multi-volume Institute for Defense Analyses (IDA) Paper P-2867 and upon request.

For this tutorial, we are focusing on the same type of simulation period that is used for the National Defense Stockpile (NDS) Report to the Congress. The NDS base case is required by law to model a 4-year period of time during which the first year is defined as the conflict year and is subsequently followed by three post conflict recovery years.

The provided notional files are set up to mimic this type of scenario with completely notional data that have no linkage to any real-world events. However, these data are sufficiently robust to test and evaluate the model's performance and the relationships between its inputs and outputs.

A “real” run of the Stockpile Sizing Module (SSM) draws upon classified data and must be done on a classified computer system. As stated previously, all of the data in this briefing are completely notional and are intended only to illustrate the model’s logic and to allow the testing and evaluation of its performance.

This briefing is intended to be used in conjunction with a training version of SSM. This training version differs from the production version only in that it uses notional data. The training version of SSM is stored on a compact disc (CD) associated with this briefing and can be obtained from the IDA Control and Distribution Department. It can be run on an unclassified computer system.

SSM is a fairly simple program and should run without difficulty on a Windows operating system. Run time is not a significant factor.

IDA Paper P-2867 is somewhat out of date, but additional and up-to-date information on SSM is available upon request.

CONCEPTUAL OVERVIEW

2. Conceptual Overview

This section provides an overview of the logic behind SSM. Individual model elements are examined in later sections.

IDA | SSM Inputs and How They Interact with Each Other

- SSM inputs define three major areas:
 - Material supply
 - Domestic
 - Foreign
 - Material demand
 - Adjustments to supply and demand.
- Shortfall occurs if $(\text{supply} - \text{adjustments}) < \text{demand}$.

SSM inputs are organized into three separate categories:

- **Supply inputs.** These inputs specify how much of each material is available from domestic and foreign sources.
- **Demand inputs.** These inputs specify the materials and quantities required to support U.S. defense, essential civilian, and emergency investment needs.
- **Supply adjustments.** These adjustments decrement the share of supply actually available to the United States to account for wartime conditions such as shipping losses and unreliable suppliers.

A shortfall occurs if supply minus adjustments is less than demand for a particular material in a particular year.

SSM also requires basic information input files, which specify factors such as the materials and countries to be studied, the length of the scenario, and so forth.

IDA | Does Supply with **Adjustments** Equal Demand?

SSM Calculations

Add U.S. and foreign supplies to calculate total world supply of each material by year.

SSM Calculations

Apply decrements to supply. Results in SSM knowing how much of each material for each country for each year is available for what uses.

SSM Calculations

Check decremented supplies of each material for each year against U.S. demand by sector.

$$\text{Supply} - \text{Adjustments} \overset{?}{=} \text{Demand}$$

Input Files

U.S. Supply
Foreign Supply of Material

Input Files

Supply Political Reliability Factors
Pro-U.S. Factors
Supply Political Reliability Codes
Supply Shipping Loss Factors
Supply Factor War Damage
Market Share
GDPs of Demanding Countries

Input Files

U.S. Requirements

This slide shows what specific input files perform what role in the shortfall calculation process.

IDA | Input File Changes and Shortfalls

All of the following are generally true *ceteris paribus* (i.e., all other things being equal or held constant):

- Increasing supply decreases existing shortfalls
 - Converse: Decreasing supply increases existing shortfalls
- Increasing supply decrements increases existing shortfalls
 - Converse: Decreasing supply decrements decreases existing shortfalls
- Increasing demand increases existing shortfalls
 - Converse: Decreasing demand decreases existing shortfalls

It is helpful to understand how altering input file values changes computed shortfalls. All of the following are true *ceteris paribus* (i.e., all other things being equal or held constant):

- Increasing U.S. domestic supplies decreases existing shortfalls, and decreasing U.S. domestic supplies increases existing shortfalls. Increasing available foreign supply decreases existing shortfalls, and decreasing available foreign supply increases existing shortfalls.¹
- Available foreign supply can decrease because of increased shipping losses, decreased ability scores (i.e., Supply Political Reliability Factors) for supplying countries, decreased willingness scores (i.e., Supply Pro-U.S. Factors) for supplying countries, changes in the Supply Political Reliability Codes assigned to supplying countries, decreased U.S. Market Share, and increased Supply Factor War Damage.
- Available foreign supply can increase because of decreased shipping losses, increased ability scores (i.e., Supply Political Reliability Factors) for supplying countries, increased willingness scores (i.e., Supply Pro-U.S. Factors) for supplying countries, changes in the Supply Political Reliability Codes assigned to supplying countries, increased U.S. Market Share, and decreased Supply Factor War Damage.
- Increasing U.S. demand for materials increases existing shortfalls, and decreasing demand for materials decreases existing shortfalls.
- U.S. material demand can increase because of many things, including increased civilian economic production, increased Future Years Defense Plan (FYDP) defense spending, increased conflict attrition/expenditure, increased emergency investment, and increased homeland damage and reconstruction.

¹ Strictly speaking, it is possible that increased U.S. domestic supplies would not decrease shortfalls and that these shortfalls would remain the same. For example, this situation could occur if the increase in U.S. domestic supplies was only for materials that were not in shortfall. Similar arguments can be made for most of the points listed here. They still are useful, however, to illustrate the general manner in which input files affect shortfall results.

BASIC INPUT FILES

3. Basic Input Files

SSM requires several input files that specify basic parameters of the scenario. These inputs include the following:

- Which files and directories should be used,
- What scenario assumptions should be made (e.g., the number of years in the scenario),
- Which countries should be considered, and
- Which materials should be considered.

This section addresses these input files.

IDA | SSM Operation

- SSM defaults for the following items are specified in files with the *.sbf extension (SSM asks for this filename at run time):
 - Modeling outputs directory,
 - Case file(s) directory,
 - Runs to be performed, which are specified as case filenames that must be located in the case file directory, and
 - Database directory, where the input files are stored.
- SSM outputs are tab-delimited text files that are stored in separate folders for each case file in the modeling outputs directory.
- The database subdirectory of the main directory must have the name *database*. It must be a subdirectory of the main directory.

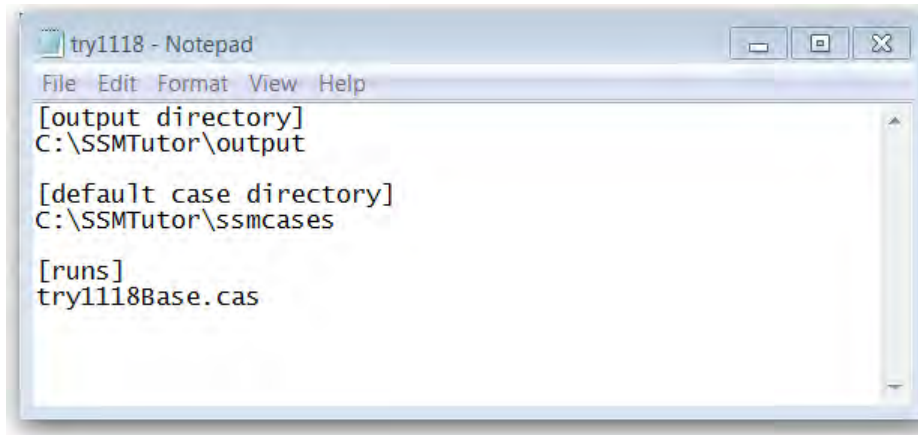
SSM input and output files use a variety of uncommon file extensions (.cas, .sbf, and so forth). Although a user's computer can give a message indicating that the file type is not recognized, all SSM files can be opened and edited with either a text editor (e.g., NotePad) or a spreadsheet program (e.g., Excel). Microsoft Excel is the recommended file editor and reader for SSM input and output files since most files are "tab-delimited text files." Notepad can also be used since it also handles most text file formats. However, Microsoft Excel has the advantage of showing tab spacing via columns, which can be of great assistance when entering and editing data. Most SSM input formats require strict adherence to format rules.

IDA | Specifying the SSM Runtime Defaults

SSM defaults are specified via a user input file with a .sbf file extension.

In the screenshot below, we have specified

- The SSM output directory,
- The SSM case file directory, and
- The name of the case file that we wish to execute.



This slide addresses specifying the SSM runtime defaults.

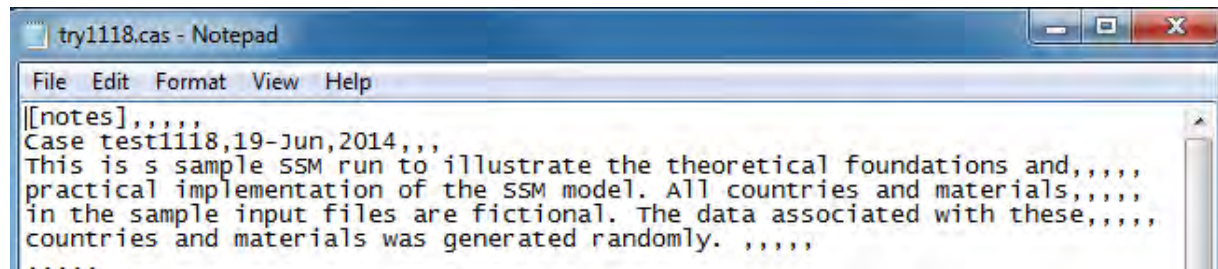
An advanced analyst/modeler can use the .sbf file to make multiple SSM runs in a single batch process, but the details are beyond the scope of this briefing, which focuses on the basics of SSM operation.

IDA | SSM Case File

The Case File specifies parameters for a particular SSM run. In other words, it defines the basic conditions and assumptions under which a particular SSM run should operate.

The Case File is a .cas file and is best opened in Notepad. A unique filename (e.g., try1118.cas) is often used to emphasize that each specific Case File is tied to a specific run of SSM.

The Case File is large and will be examined in sections, each of which corresponds to a particular set of parameters specified in the following Case File:



```
try1118.cas - Notepad
File Edit Format View Help
[[notes],,,,,
Case test1118,19-Jun,2014,,
This is s sample SSM run to illustrate the theoretical foundations and,,,,
practical implementation of the SSM model. All countries and materials,,,,
in the sample input files are fictional. The data associated with these,,,,
countries and materials was generated randomly. ,,,,
.....
```


The Case File allows the user to control almost all SSM inputs. Except for the notes section and the header in brackets, the lines in the Case File are delimited. The SSM can read either tab delimiting or comma delimiting. The Case File can be edited in Excel as a delimited text file and then resaved. A comma-delimited file can be edited in Notepad, but the comma is a delimiter character and should be treated as such.

IDA | Case File: Scenario Parameters

The Scenario Parameters section of the Case File allows the user to specify the following:

- **Total years.** Number of years in the scenario.
- **Starting year.** The year in which the scenario begins.
- **Warning years.** Years in the scenario before the war starts in which the country can take action to support the war effort.
- **Shortfall years.** Whether shortfalls in warning years (if extant) should be included in total shortfall calculations.



```
try1118.cas - Notepad
File Edit Format View Help
[scenario parameters],,,,
1,total_years,4,,,
2,starting_year,2011,,,
3,warning_years,0,,,
4,shortfall_years,0,,,
,,,
```

The input value for “Total Years” is almost always 4, in line with Congressional guidance in the Strategic and Critical Materials Stockpiling Act (“... The stockpile requirements shall be based on those strategic and critical materials [S&CM] necessary for the United States to replenish or replace, within three years of the end of the [year-long] military conflict scenario ...”).

The input value for “Starting Year” depends on the National Defense Stockpile (NDS) Requirements Report cycle for which the analysis is being conducted.

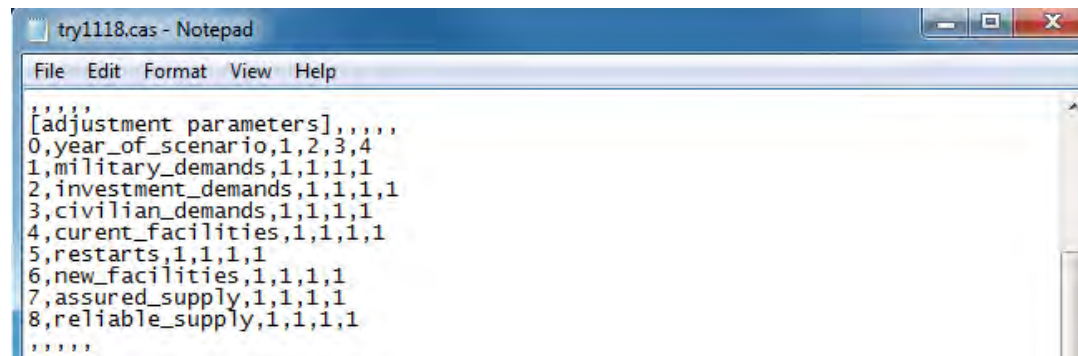
The input values for “Warning Years” and “Shortfall Years” often are 0.

IDA | Case File: Adjustment Parameters

Adjustment Parameters allow the user to adjust SSM parameters by some fixed factor for a particular year.

For example, in the file below, modifying *military_demands* to 2, 0.5, 1, 1 would double military material demand in the first year of the scenario, halve it in the second year, and leave it at its original base value in the third and fourth years.

The meaning of these parameters is explained later. For now, it is most important to grasp that the Case File allows adjustment of the parameters.



```
[adjustment parameters],,,,,  
0,year_of_scenario,1,2,3,4  
1,military_demands,1,1,1,1  
2,investment_demands,1,1,1,1  
3,civilian_demands,1,1,1,1  
4,current_facilities,1,1,1,1  
5,restarts,1,1,1,1  
6,new_facilities,1,1,1,1  
7,assured_supply,1,1,1,1  
8,reliable_supply,1,1,1,1  
,,,,,
```

The first entry in this example file, *year_of_scenario*, is declaring the format for subsequent entries. It ensures that SSM “knows” an entry of four comma-separated values is referring to the 4 years of the scenario (e.g., 2, 0.5, 1, 1 means an adjustment of 2 for the first year, 0.5 for the second, 1 for the third, and 1 for the fourth). This convention is used in many time-phased SSM parameter inputs.

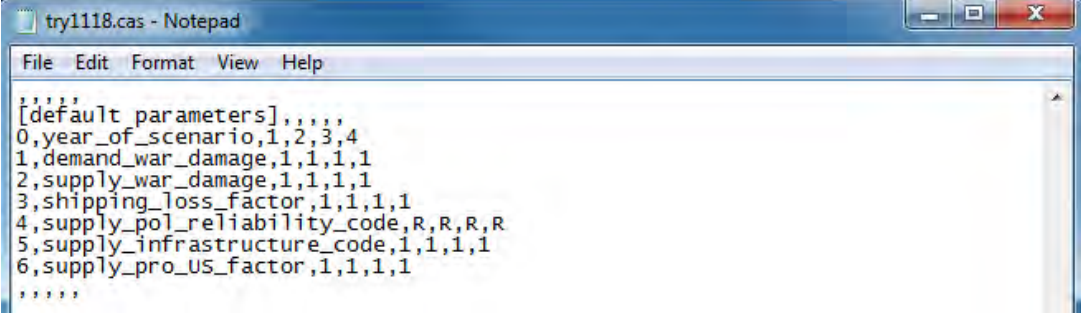
Values must be between zero and two. A value of one means no adjustment will be made (e.g., it will be multiplied by one and, hence, unchanged).

These options are rarely used, and a new user is advised to leave them set at 1.

IDA | Case File: Default Parameters

Default Parameters specify what values SSM should use in case of missing data.

For example, a separate input file for Shipping Losses specifies what percentage of material supplies from a particular country is deemed unavailable to the United States during the conflict scenario because of enemy attacks against shipping. Each country has its own entry for each year. The Case File in the screenshot below specifies that if data for a particular country in the Shipping Losses input file are missing, SSM should use 1 (which corresponds to no shipping lost) as the default value.



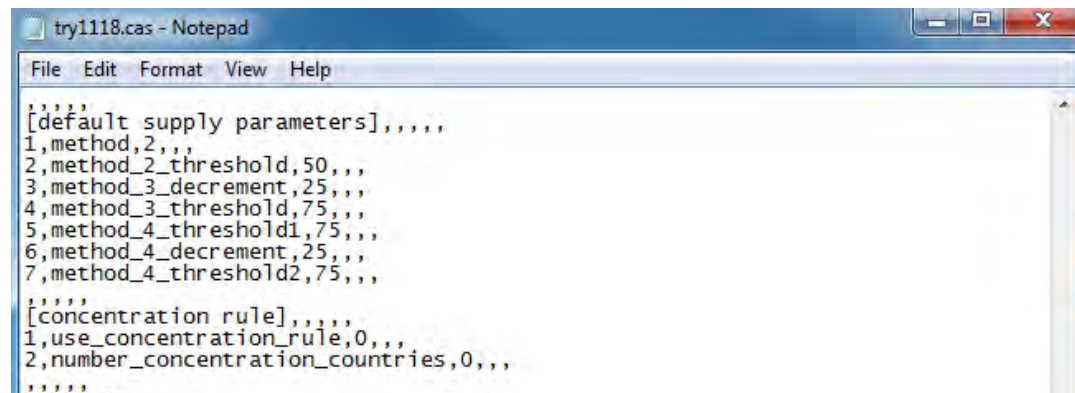
```
try1118.cas - Notepad
File Edit Format View Help
'''
[default parameters],,,,
0,year_of_scenario,1,2,3,4
1,demand_war_damage,1,1,1,1
2,supply_war_damage,1,1,1,1
3,shipping_loss_factor,1,1,1,1
4,supply_pol_reliability_code,R,R,R,R
5,supply_infrastructure_code,1,1,1,1
6,supply_pro_US_factor,1,1,1,1
''',,
```

The Default Parameters entered here do *not* override data inputs entered elsewhere. All of the parameters listed here have separate input files. SSM will use the values entered in those files *unless* data for a particular country or year are missing, in which case SSM reverts to the Default Parameters specified in the Case File.

The exact meaning of these values is explained later in this document. For now, it is important to understand that the Case File allows one to use Default Parameters to deal with missing or incomplete data.

IDA | Case File: Default Supply Parameters and Concentration Rule

Default Supply Parameters and Concentration Rule allow the user to modify details of the algorithms used in various SSM computations. However, they are beyond the scope of this beginner tutorial and will not be examined.



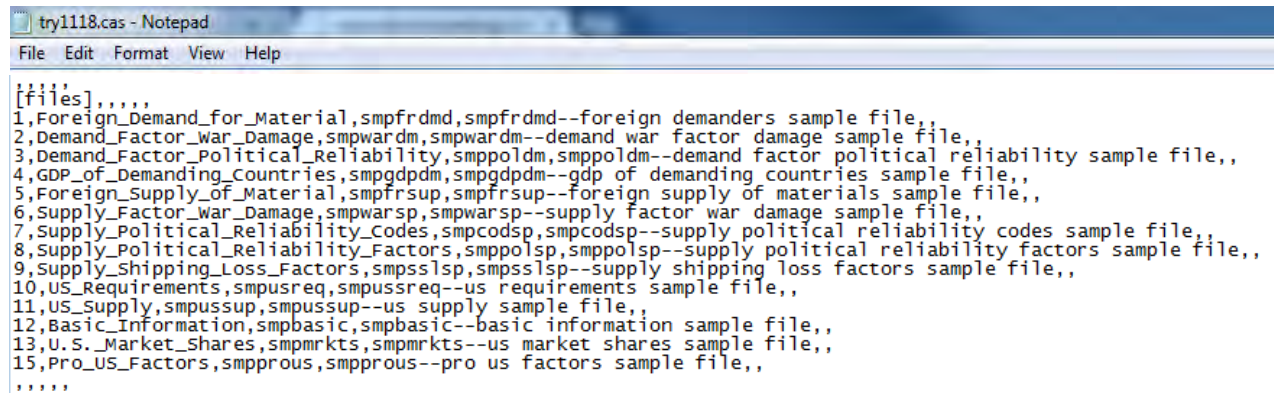
```
try1118.cas - Notepad
File Edit Format View Help
'''
[default supply parameters],,,,
1,method,2,,,
2,method_2_threshold,50,,,
3,method_3_decrement,25,,,
4,method_3_threshold,75,,,
5,method_4_threshold1,75,,,
6,method_4_decrement,25,,,
7,method_4_threshold2,75,,,
'''
[concentration rule],,,,
1,use_concentration_rule,0,,,
2,number_concentration_countries,0,,,
'''
```


Explanations of the various supply calculation methods and concentration rules can be found in IDA Paper P-2867.

IDA Case File: Files

The Files section specifies what data input files SSM should use. For example, in the file in the screenshot below, the *Foreign_Demand_for_Material, smpfrdmd, smpfrdmd--foreign demanders sample file* entry specifies that SSM should use a file called smpfrdmd that contains sample information on foreign demand by material. These files must be in the database subdirectory of the main directory, as declared in the .sbf file (see slide 8).

This information corresponds with a separate configuration file, longname.ini. (see slide 16).



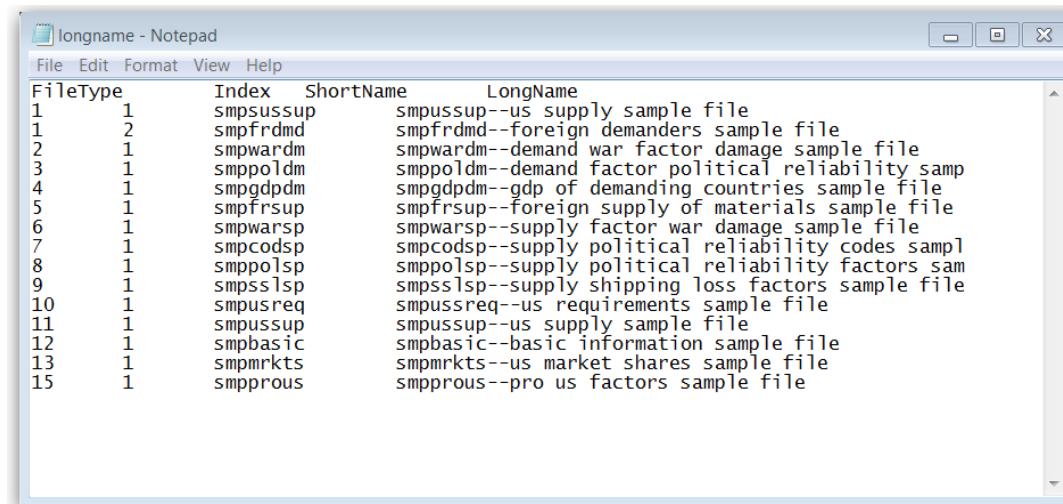
```
[[files],,,,,
1,Foreign_Demand_for_Material,smpfrdmd,smpfrdmd--foreign demanders sample file,,
2,Demand_Factor_War_Damage,smpwardm,smpwardm--demand war factor damage sample file,,
3,Demand_Factor_Political_Reliability,smpoldm,smpoldm--demand factor political reliability sample file,,
4,GDP_of_Demanding_Countries,smpgdpm,smpgdpm--gdp of demanding countries sample file,,
5,Foreign_Supply_of_Material,smpfrsup,smpfrsup--foreign supply of materials sample file,,
6,Supply_Factor_War_Damage,smpwarsp,smpwarsp--supply factor war damage sample file,,
7,Supply_Political_Reliability_Codes,smpcodsp,smpcodsp--supply political reliability codes sample file,,
8,Supply_Political_Reliability_Factors,smpplsp,smpplsp--supply political reliability factors sample file,,
9,Supply_Shipping_Loss_Factors,smpsslsp,smpsslsp--supply shipping loss factors sample file,,
10,US_Requirements,smpusreq,smpusreq--us requirements sample file,,
11,US_Supply,smpussup,smpussup--us supply sample file,,
12,Basic_Information,smpbasic,smpbasic--basic information sample file,,
13,U.S._Market_Shares,smpmrkts,smpmrkts--us market shares sample file,,
15,Pro_US_Factors,smpprous,smpprous--pro us factors sample file,,
,,,,,
```

The meaning and use of these files are examined later in this document.

The lines in the screenshot in this slide are comma delimited and contain the file type number (hard coded), the file type name (hard coded), the short filename (eight characters max), and the long filename.

IDA | SSM File longname.ini

SSM Control File longname.ini establishes a file type for the SSM input files. The input file types run numerically from 1 to 15, as shown in the screenshot below. More detail is contained in IDA Paper P-2867 and the RAMF-SM Step 2 Overview. The user does not have to deal with this file, since it is automatically updated by the SSM program.

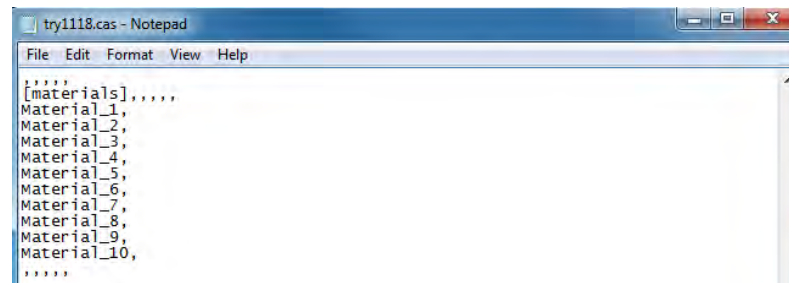


FileType	Index	ShortName	LongName
1	1	smpsussup	smpussup--us supply sample file
1	2	smpfrdmd	smpfrdmd--foreign demanders sample file
2	1	smpwardm	smpwardm--demand war factor damage sample file
3	1	smppldmd	smppldmd--demand factor political reliability samp
4	1	smpgdpdm	smpgdpdm--gdp of demanding countries sample file
5	1	smpfrsup	smpfrsup--foreign supply of materials sample file
6	1	smpwarsp	smpwarsp--supply factor war damage sample file
7	1	smpcodsp	smpcodsp--supply political reliability codes sampl
8	1	smpplsp	smpplsp--supply political reliability factors sam
9	1	smpsslsp	smpsslsp--supply shipping loss factors sample file
10	1	smpusreq	smpussreq--us requirements sample file
11	1	smpussup	smpussup--us supply sample file
12	1	smpbasic	smpbasic--basic information sample file
13	1	smpmrkts	smpmrkts--us market shares sample file
15	1	smpprous	smpprous--pro us factors sample file

In the screenshot in this slide, note that there is no file 14. It is an optional file beyond the scope of this beginner tutorial. There is also an optional file 16 (not pictured) that is used with the “Expanded Market Share” option, as explained on Slide 18.

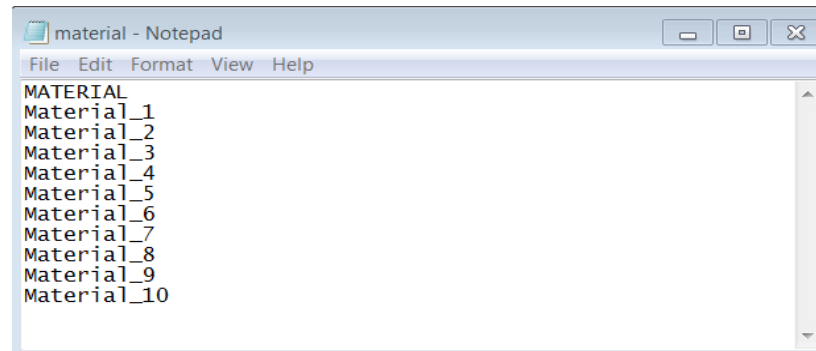
IDA | Case File: Materials

The Case File allows the user to specify what materials to study.



```
[materials],,,,
Material_1,
Material_2,
Material_3,
Material_4,
Material_5,
Material_6,
Material_7,
Material_8,
Material_9,
Material_10,
,,,,,
```

This file corresponds with a separate input file, material.txt. A screenshot of the test data used for material.txt is shown below. The material.txt file must reside in the database subdirectory.



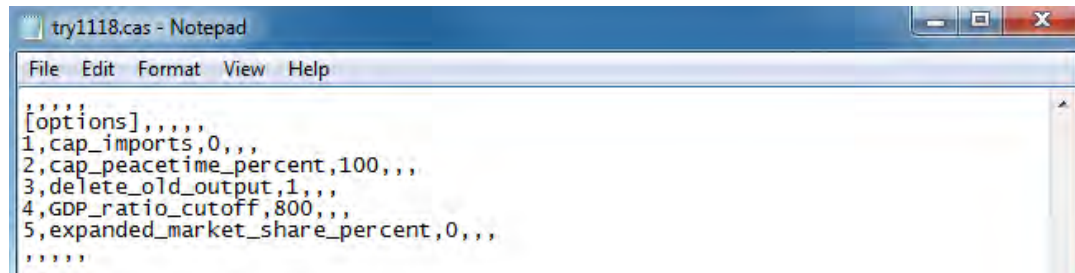
```
MATERIAL
Material_1
Material_2
Material_3
Material_4
Material_5
Material_6
Material_7
Material_8
Material_9
Material_10
```

The sponsor typically judges what S&CM should be included. The list of materials varies between different NDS Requirement Report cycles. In the SSM, information is correctly matched either by material name or country name. To facilitate this matching and reduce errors, all entries must match entries in master lists. The master material list is in the material.txt file. When a case is run, the SSM checks all input files against the master material list. If there are any material names that do not match entries in the master list, an error message will be generated. A similar process is used to verify countries against a master list, as covered on pages 38 and 39. Note that the list of materials in a Case File has to be a subset of the materials in material.txt, but not all the materials listed in material.txt need be treated in a given case.

IDA | Case File: Options

Lastly, the Case File contains a number of miscellaneous options:

- **Cap Imports** allows the user to cap imports at some percentage of peacetime levels.
- **Cap Peacetime Percent** allows the user to define this percentage.
- **Delete Old Output** will delete all old output files that have been generated for the case or cases to be run.
- **GDP Ratio Cutoff** and **Expanded Market Share Percent** are explained in the notes to this slide.



```
try1118.cas - Notepad
File Edit Format View Help
[options],,,,,
1,cap_imports,0,,,
2,cap_peacetime_percent,100,,,
3,delete_old_output,1,,,
4,GDP_ratio_cutoff,800,,,
5,expanded_market_share_percent,0,,,
,,,,,
```

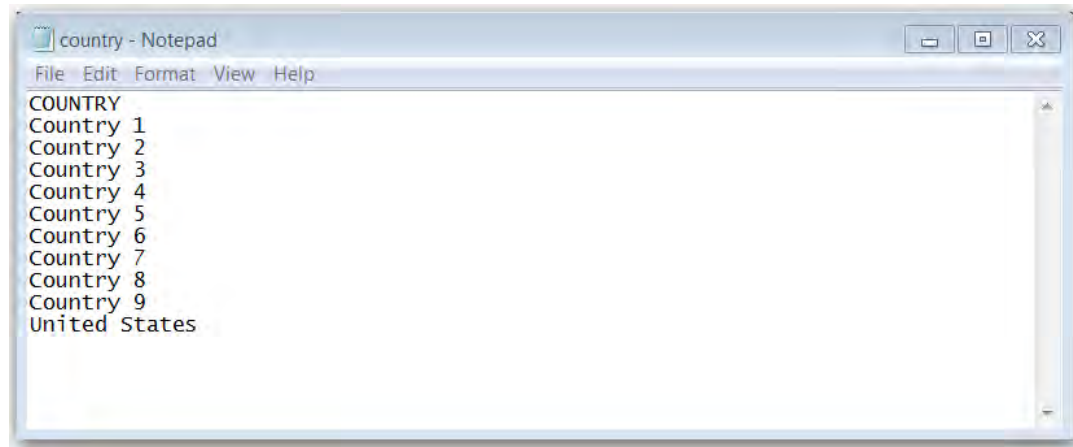

GDP Ratio Cutoff applies to an algorithm used in SSM to model the delayed supply of materials. Some countries are assumed to restrict their supply of S&CM to the United States because of anti-American political sentiment (see Slide 27). Even if these countries do not intend to export to the United States, the United States likely can obtain materials once these materials have entered the world market by purchasing through intermediaries. However, purchasing through intermediaries is more circuitous and time consuming than direct purchase. As such, supplies are assumed to be available to the United States after a time delay. This delay is computed as a function of the ratio of the supplier country's entry in the GDP input file to the U.S. entry, with a higher ratio resulting in a longer delay.

Expanded Market Share Percent refers to an SSM feature in which the United States can obtain not just its regular share of foreign supply, but also an expanded share of previously-unused foreign production capacity.

IDA | Specifying the Countries of Interest

All countries of interest are input via the file country.txt.

The screenshot below shows an example of the file that will be used for training purposes.

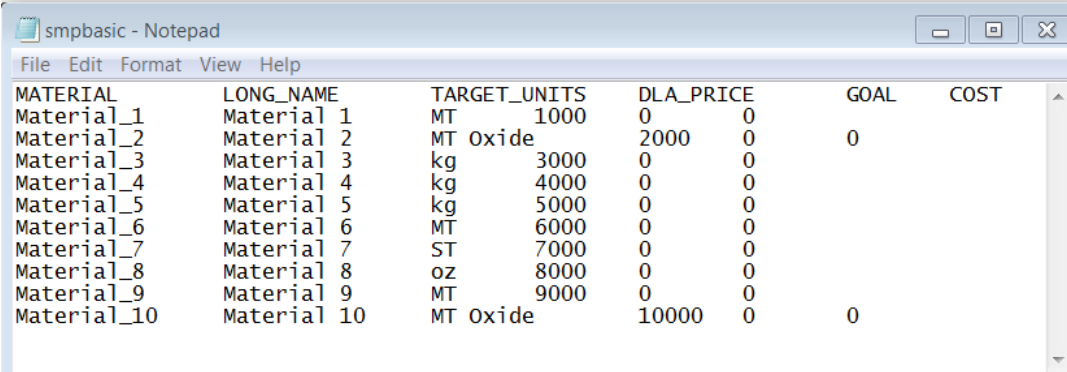


The country input file must include an entry for every country that is a supplier (source for) or demander (user of) the strategic materials that will be analyzed. This list is usually a function of the materials being studied and the countries whose industrial bases consume these materials. SSM checks the country names in the data files against the entries in country.txt and notes any missing countries (including misspelled country names).

IDA | Input of Material-Specific Information

Material-specific information is input via file `smbasic.txt`, as follows:

- Field one contains the short name for the material used in the program.
- Field two contains the descriptive name of the material (used in output reports).
- Field three is the units used for the material.
- Field four is the price per unit.
- Field five contains the current statutory goal (not typically used and set to 0).
- Field six contains the cost of the statutory goal calculated with the price per unit in field four (also typically not used and set to 0).



MATERIAL	LONG_NAME	TARGET_UNITS	DLA_PRICE	GOAL	COST
Material_1	Material 1	MT 1000	0 0		
Material_2	Material 2	MT Oxide	2000 0	0	
Material_3	Material 3	kg 3000	0 0		
Material_4	Material 4	kg 4000	0 0		
Material_5	Material 5	kg 5000	0 0		
Material_6	Material 6	MT 6000	0 0		
Material_7	Material 7	ST 7000	0 0		
Material_8	Material 8	oz 8000	0 0		
Material_9	Material 9	MT 9000	0 0		
Material_10	Material 10	MT Oxide	10000 0	0	

Materials often have informal short names but also have more formal long names. SSM permits the use of both names and allows the user to input this information into the model. Similarly, materials are sold in differing units on the world market. As such, SSM uses the material units that are most commonly used for a given material (i.e., TARGET_UNITS). To understand the material costs involved, the price that DLA pays for a given unit of a specific material is entered for each material in the DLA_PRICE column. If some statutory goal has been established for a specific material, the goal is input in the required units, and the cost of that goal is entered. Currently, most runs of SSM assume that no statutory goals are in effect, and the values and costs are therefore set to zero. The amount of statutory goal, if any, does not affect the material shortfall computation.

SUPPLY INPUT FILES

4. Supply Input Files

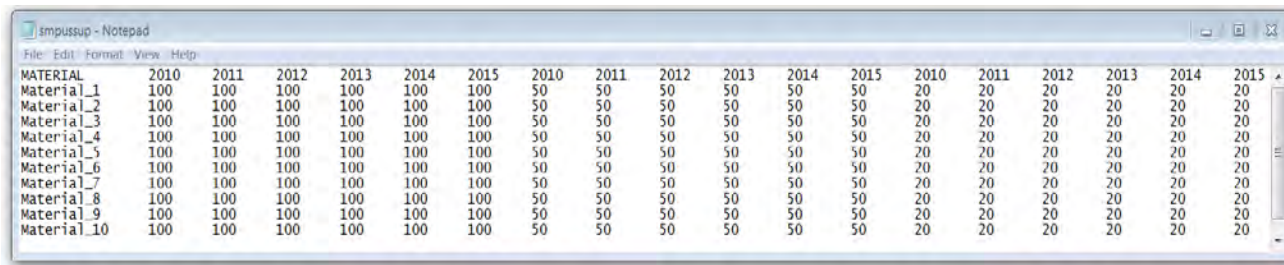
To compute available supplies, SSM must first take into account base foreign and U.S. supplies.

IDA Inputs for U.S. Material Supplies

The file smpussup.txt contains U.S. supply figures for current facilities, restarts, and new starts for each year for each material.

All figures are in the units specified in the basic information file. Note that the years in the first row are repeated three times. The first set is for current facilities, the second set is for restarts, and the third set is for new starts.

This information is used in the supply calculations. The materials are listed in the first field in alphabetical order. The subsequent fields show U.S. supply by year and facility type (current, restart, or new).



MATERIAL	2010	2011	2012	2013	2014	2015	2010	2011	2012	2013	2014	2015	2010	2011	2012	2013	2014	2015
Material_1	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_2	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_3	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_4	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_5	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_6	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_7	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_8	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_9	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20
Material_10	100	100	100	100	100	100	50	50	50	50	50	50	20	20	20	20	20	20

U.S. supply refers to domestic supplies of each material for each year of the scenario. This information is supplied by the U.S. Geological Survey (USGS) and subject matter experts (SMEs).

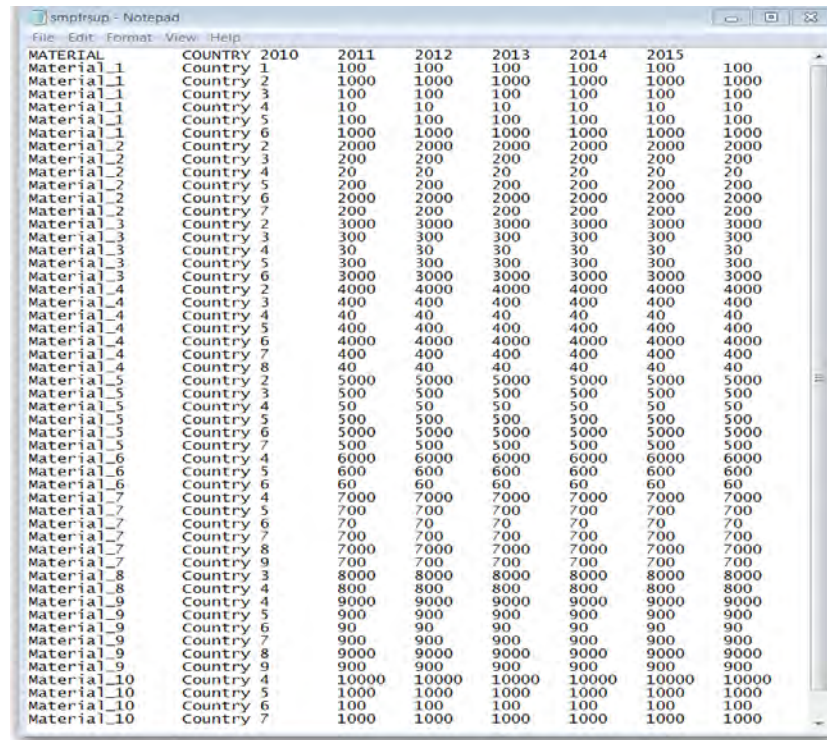
Domestic supply consists of three components:

- Current U.S. production capacity,
- Supply restarts (i.e., the amount available if currently closed facilities were restarted), and
- New supply starts (i.e., the amount available if new production facilities were brought online).

Current U.S. production capacity is considered to encompass capacity clearly expected to be in place in the scenario period. Restarts and new starts (often referred to as “concerted programs”) often are not included in the Department of Defense (DOD) stockpile analysis, even though the sample database does include them. They represent facilities that are not expected to be in production during the scenario period and would require considerable special investment to be brought online.

IDA Inputs of Foreign Material Supply

Foreign material supply is input via file `smprsup.txt`. A screenshot is shown below.



MATERIAL	COUNTRY	2010	2011	2012	2013	2014	2015
Material 1	Country 1	100	100	100	100	100	100
Material 1	Country 2	1000	1000	1000	1000	1000	1000
Material 1	Country 3	100	100	100	100	100	100
Material 1	Country 4	10	10	10	10	10	10
Material 1	Country 5	100	100	100	100	100	100
Material 1	Country 6	1000	1000	1000	1000	1000	1000
Material 2	Country 2	2000	2000	2000	2000	2000	2000
Material 2	Country 3	200	200	200	200	200	200
Material 2	Country 4	20	20	20	20	20	20
Material 2	Country 5	200	200	200	200	200	200
Material 2	Country 6	2000	2000	2000	2000	2000	2000
Material 2	Country 7	200	200	200	200	200	200
Material 3	Country 2	3000	3000	3000	3000	3000	3000
Material 3	Country 3	300	300	300	300	300	300
Material 3	Country 4	30	30	30	30	30	30
Material 3	Country 5	300	300	300	300	300	300
Material 3	Country 6	3000	3000	3000	3000	3000	3000
Material 4	Country 2	4000	4000	4000	4000	4000	4000
Material 4	Country 3	400	400	400	400	400	400
Material 4	Country 4	40	40	40	40	40	40
Material 4	Country 5	400	400	400	400	400	400
Material 4	Country 6	4000	4000	4000	4000	4000	4000
Material 4	Country 7	400	400	400	400	400	400
Material 4	Country 8	40	40	40	40	40	40
Material 5	Country 2	5000	5000	5000	5000	5000	5000
Material 5	Country 3	500	500	500	500	500	500
Material 5	Country 4	50	50	50	50	50	50
Material 5	Country 5	500	500	500	500	500	500
Material 5	Country 6	5000	5000	5000	5000	5000	5000
Material 5	Country 7	500	500	500	500	500	500
Material 6	Country 4	6000	6000	6000	6000	6000	6000
Material 6	Country 5	600	600	600	600	600	600
Material 6	Country 6	60	60	60	60	60	60
Material 7	Country 4	7000	7000	7000	7000	7000	7000
Material 7	Country 5	700	700	700	700	700	700
Material 7	Country 6	70	70	70	70	70	70
Material 7	Country 7	700	700	700	700	700	700
Material 7	Country 8	7000	7000	7000	7000	7000	7000
Material 7	Country 9	700	700	700	700	700	700
Material 8	Country 3	8000	8000	8000	8000	8000	8000
Material 8	Country 4	800	800	800	800	800	800
Material 9	Country 4	9000	9000	9000	9000	9000	9000
Material 9	Country 5	900	900	900	900	900	900
Material 9	Country 6	90	90	90	90	90	90
Material 9	Country 7	900	900	900	900	900	900
Material 9	Country 8	9000	9000	9000	9000	9000	9000
Material 9	Country 9	900	900	900	900	900	900
Material 10	Country 4	10000	10000	10000	10000	10000	10000
Material 10	Country 5	1000	1000	1000	1000	1000	1000
Material 10	Country 6	100	100	100	100	100	100
Material 10	Country 7	1000	1000	1000	1000	1000	1000

Foreign material supply can be calculated on the basis of current production or total capacity. USGS normally provides this information. Note that material supply is broken down by material, country, and year. The actual U.S. share of foreign material supply will almost certainly be smaller than the amount input here since SSM applies decrements to these amounts to account for a wide variety of factors (e.g., political reliability, shipping losses, and so forth), as covered in the next section.

SUPPLY DECREMENT INPUT FILES

5. Supply Decrement Input Files

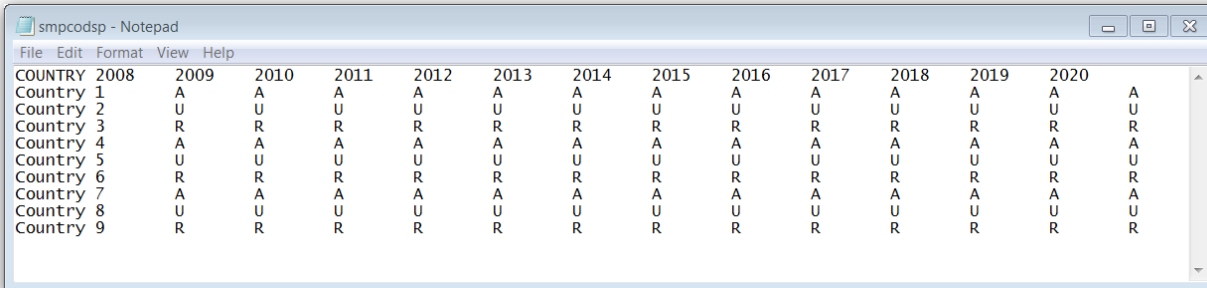
SSM now must decrement the aforementioned base supplies to account for wartime conditions that could decrease the share of supplies actually available to the United States. Decrement factors include supply political reliability codes, political reliability factors, pro-U.S. factors, supply war damage factors, country shipping losses, and U.S. market share. Each of these concepts is entered into SSM via an input file. This section examines the use and provenance of decrement-related input files.

IDA | Input of Supply Political Reliability Codes

SSM uses political reliability codes to determine whether supplier countries are assured, reliable, or unreliable suppliers of the materials that they supply.

Material supplies from assured countries can be used to satisfy U.S. civilian, defense, and emergency investment demands. Material supplies from reliable countries can be used to satisfy U.S. civilian demands (but not defense or emergency investment). Material supplies from unreliable countries cannot be used to satisfy any U.S. demands.

Political reliability codes are input via file smpcodsp.txt. A screenshot of a typical file is shown below. Note that the file contains the country name, the year, and a code letter A, U, or R to designate their reliability in a given year.



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
COUNTRY													
Country 1	A	A	A	A	A	A	A	A	A	A	A	A	A
Country 2	U	U	U	U	U	U	U	U	U	U	U	U	U
Country 3	R	R	R	R	R	R	R	R	R	R	R	R	R
Country 4	A	A	A	A	A	A	A	A	A	A	A	A	A
Country 5	U	U	U	U	U	U	U	U	U	U	U	U	U
Country 6	R	R	R	R	R	R	R	R	R	R	R	R	R
Country 7	A	A	A	A	A	A	A	A	A	A	A	A	A
Country 8	U	U	U	U	U	U	U	U	U	U	U	U	U
Country 9	R	R	R	R	R	R	R	R	R	R	R	R	R

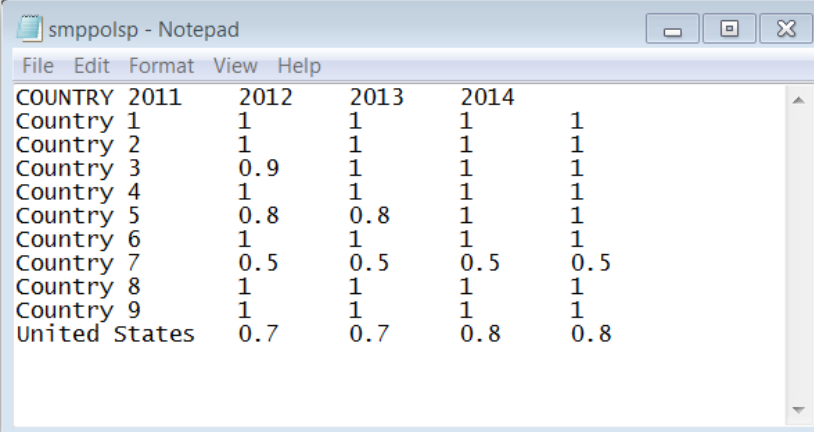
The code names and letters have specialized meanings. Assured (A) countries' material supplies can be used to meet civilian, defense, and emergency investment material demands. Reliable (R) countries' material supplies can be used to meet civilian demands only. Unreliable (U) countries cannot have their material supplies used to meet any demands (i.e., the computer program ignores input supply values and sets the usable supply to zero).

Note that values for a particular country can vary by year (i.e., a country that is assured during one year can be coded as reliable or unreliable in a different year and vice versa). Note also that political reliability *codes* are distinct from political reliability *factors*, which are covered on the next slide. The former specifies what tiers of demand can be satisfied by supply from a particular country, while the latter specifies what percentage of supply from a particular country is likely to be available for consumption.

IDA | Input of Country Political Reliability Factors

File smppolsp.txt contains the political reliability factors for each country and the year of the scenario. In this file, 0.9 indicates that 10% of the country's supply is assumed to be unavailable.

The country is the first field and must be in alphabetical order. The political reliability factors are in the subsequent columns, which represent each year. In practice, these factors are usually obtained through subject matter experts (SMEs).



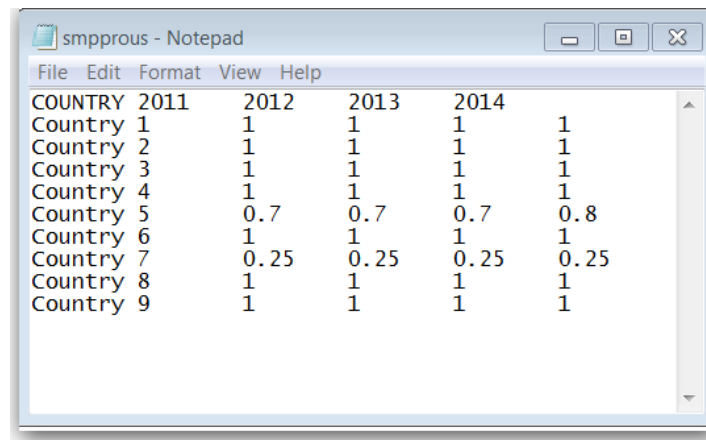
COUNTRY	2011	2012	2013	2014
Country 1	1	1	1	1
Country 2	1	1	1	1
Country 3	0.9	1	1	1
Country 4	1	1	1	1
Country 5	0.8	0.8	1	1
Country 6	1	1	1	1
Country 7	0.5	0.5	0.5	0.5
Country 8	1	1	1	1
Country 9	1	1	1	1
United States	0.7	0.7	0.8	0.8

Reliability was formerly represented as a single factor. It has since been disaggregated into *ability* (i.e., to what degree could poor infrastructure, labor unrest, and so forth prevent an otherwise willing country from supplying the United States) and *willingness* (i.e., to what degree could anti-American sentiment lead an otherwise able country to reduce supplies to the United States). The Supply Political Reliability Factors input file defines the *ability* of a country to produce to its stated industrial capability or capacity in a given year. Note that these values can change from year to year to reflect ongoing conditions within a given country. The factor value, which must be between zero and one, represents the fraction of its supply that the country *is* able to produce in the given year.

IDA | Input of Pro-U.S. Sentiment

Foreign sentiment toward the United States is input into SSM via the file smpprou.txt. The first field in the file lists the countries in alphabetical order. For each scenario year, a “pro-U.S.” factor is given in the subsequent fields.

Anti-U.S. sentiment is modeled as causing delay in the delivery of material supplies to the United States. A “1” indicates totally pro-U.S. sentiment and that no portion of material supply from that country is subject to delay, while a “0” indicates totally anti-U.S. sentiment and that all material supply from that country is subject to delay. The length of the delay is determined by other inputs.



COUNTRY	2011	2012	2013	2014
Country 1	1	1	1	1
Country 2	1	1	1	1
Country 3	1	1	1	1
Country 4	1	1	1	1
Country 5	0.7	0.7	0.7	0.8
Country 6	1	1	1	1
Country 7	0.25	0.25	0.25	0.25
Country 8	1	1	1	1
Country 9	1	1	1	1

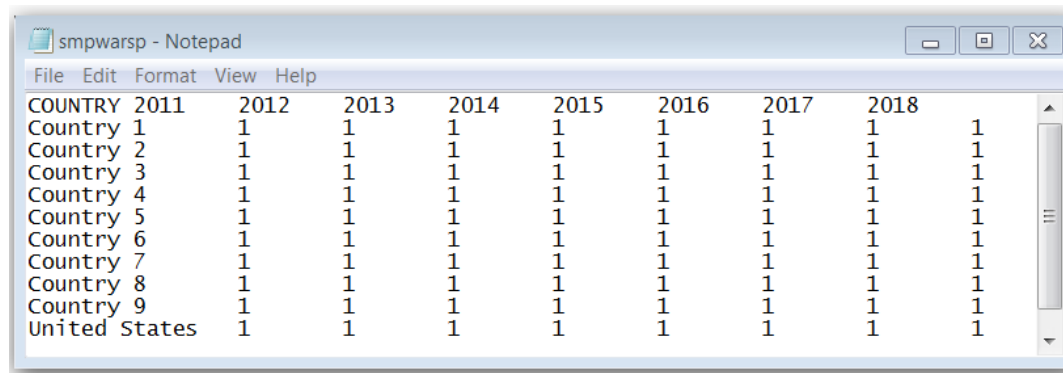
The Pro-U.S. Factors input file defines the *willingness* of a country to produce to its stated industrial capability or capacity in a given year. Note that these values can change from year to year to reflect ongoing conditions within a given country

IDA | Input of Country War Damage Factors

The file smpwarsp.txt contains the war damage factors for countries that supply S&CM. In this file, the figure 0.75 indicates that the supplier has lost 25% of supply capability to war damage. This information is used in the supply calculations.

The first field is a list of the countries in alphabetical order. The first row must have the years in chronological order. Each data cell represents the war damage factor a country in a specified year.

The screenshot below indicates no war damage for any country.

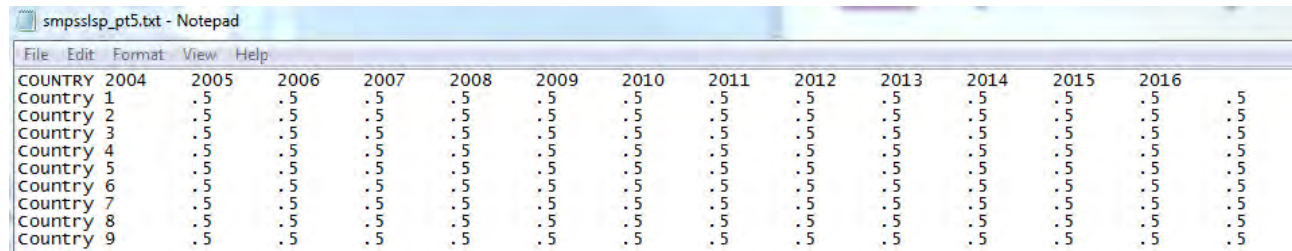


	2011	2012	2013	2014	2015	2016	2017	2018
COUNTRY	1	1	1	1	1	1	1	1
Country 1	1	1	1	1	1	1	1	1
Country 2	1	1	1	1	1	1	1	1
Country 3	1	1	1	1	1	1	1	1
Country 4	1	1	1	1	1	1	1	1
Country 5	1	1	1	1	1	1	1	1
Country 6	1	1	1	1	1	1	1	1
Country 7	1	1	1	1	1	1	1	1
Country 8	1	1	1	1	1	1	1	1
Country 9	1	1	1	1	1	1	1	1
United States	1	1	1	1	1	1	1	1

This information is calculated by IDA based on conflict parameters specified by the Office of the Undersecretary of Defense for Policy (OUSD(P)) in classified Defense Planning Scenarios. This factor can be used to specify the percentage of capacity that is available on a year-by-year basis for each country during the analysis period being considered.

IDA | Input of Country Shipping Losses

The file smpsslsp.txt contains the shipping loss factors for countries that supply S&CM. In this file, the figure 0.5 indicates that 50% of the country's supply to the United States is lost in transit due to enemy attack, and therefore does not arrive in the United States. A value of 0.8 would mean that 20% is lost in transit.



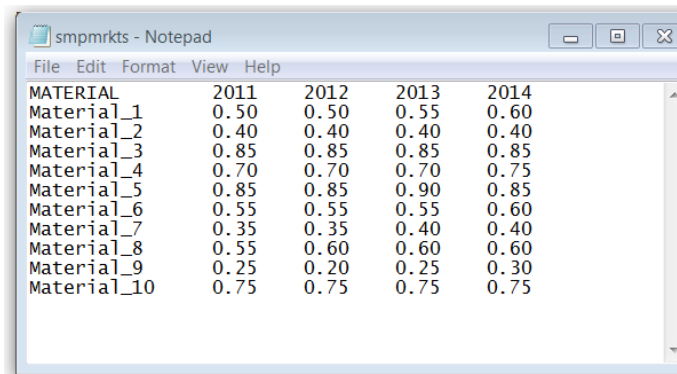
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
COUNTRY													
Country 1	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 2	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 3	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 4	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 6	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 7	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 8	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Country 9	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5

This information is supplied by OUSD(P) based on classified Defense Planning Scenarios. This factor indicates the loss of supplies due to degradation in shipping of S&CM.

IDA | Input of U.S. Market Share Inputs

There are two methods of implementing market share in SSM. The user can calculate market share *outside* of SSM and enter values into a Market Share input file (smpmrkts), or the user can enter multiple input files that SSM uses to calculate market share *within* the model. Since the first method is preferred, the user should use the Market Share input file. However, due to legacy code issues, the user still must enter the extra input files (Foreign Demanders, Demand Factor Political Reliability, and Demand Factor War Damage). These extra input files should be constructed as “null files” (i.e., with the correct header names but with no entries). See the notes to this slide for details.

In the market share file in the screenshot below, the first field is the material, and the subsequent entries are U.S. market shares of that material in the given year.



MATERIAL	2011	2012	2013	2014
Material_1	0.50	0.50	0.55	0.60
Material_2	0.40	0.40	0.40	0.40
Material_3	0.85	0.85	0.85	0.85
Material_4	0.70	0.70	0.70	0.75
Material_5	0.85	0.85	0.90	0.85
Material_6	0.55	0.55	0.55	0.60
Material_7	0.35	0.35	0.40	0.40
Material_8	0.55	0.60	0.60	0.60
Material_9	0.25	0.20	0.25	0.30
Material_10	0.75	0.75	0.75	0.75

In the context of the SSM, the term “U.S. market share” refers to the fraction of foreign supply (of a given material) that the United States can obtain. It operates in addition to the other decrement factors. The U.S. market share can be calculated within SSM. In practice, it typically is calculated outside of SSM and entered via this input file. The procedure for calculating U.S. market share is to use three different algorithms, choose the highest result as the initial peacetime market share, apply decrement factors, and use the result as the U.S. foreign market share input file for SSM.

The three market share calculation methods are the gross domestic product (GDP) method (in which U.S. market share of a particular material is equal to the ratio of the U.S. GDP to the sum of the GDPs of all countries—including the United States—that demand the material), the production method (in which U.S. market share for a given material is equal to the ratio of U.S. imports to foreign production), and the Peacetime Equilibrium Adjustment Process (which is too lengthy to describe here but can be explained upon request).

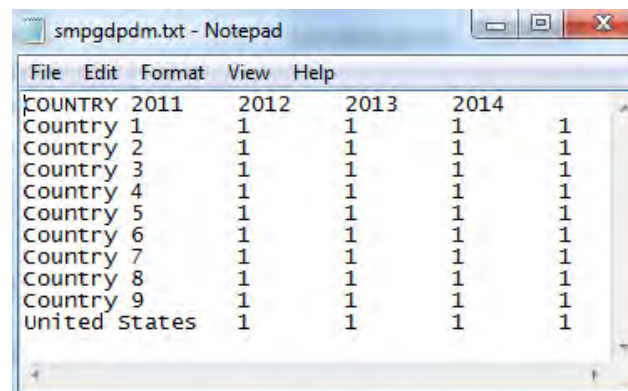
Whatever market share calculation method produces the highest estimate is chosen as the initial peacetime market share. Due to legacy code issues, three extra input files must be applied to transform the initial peacetime market share into a share appropriate for the conflict scenario:

- **Foreign Demanders.** This input file lists the countries that demand S&CM and, hence, are market competitors of the United States.
- **Demand Factor Political Reliability.** This input file refers to countries that are not part of the U.S. trading bloc and, hence, should not be considered market competitors. These countries (typically coded as U.S. government-listed state sponsors of terror) are omitted from the aforementioned market share calculations.
- **Demand Factor War Damage.** This input file refers to the decrease in foreign demand for a particular material resulting from war damage to production facilities (e.g., a bombed-out steel factory will demand less iron) and is calculated by IDA on the basis of classified Defense Planning Scenarios.

The SSM has input files for these quantities (legacy code); however, in practice, they are used in an offline (Excel) calculation, and dummy null files are input to the SSM. The values resulting after these decrements are used as the market share inputs. Note that market share varies by material and year but not by country.

IDA | Input of GDPs

The GDP input file (smpgdpdm) shows GDP figures for each country that demands S&CM. All figures are in billions of dollars. This information is used to model the length of delay in the delivery of supplies to the United States as a result of anti-U.S. sentiment.



COUNTRY	2011	2012	2013	2014
Country 1	1	1	1	1
Country 2	1	1	1	1
Country 3	1	1	1	1
Country 4	1	1	1	1
Country 5	1	1	1	1
Country 6	1	1	1	1
Country 7	1	1	1	1
Country 8	1	1	1	1
Country 9	1	1	1	1
United States	1	1	1	1

CIA *World Factbook* estimates are used for country GDPs. In SSM, GDP is a proxy for national strength. A stronger country likely can withhold material supplies from the United States for a longer period of time. As such, the ratio of country GDP vs. U.S. GDP is used to calculate the length of delay. Note that the portion of a country's material supply production that is subject to delay is determined by that country's Pro-U.S. Factor, as explained on Slide 27.

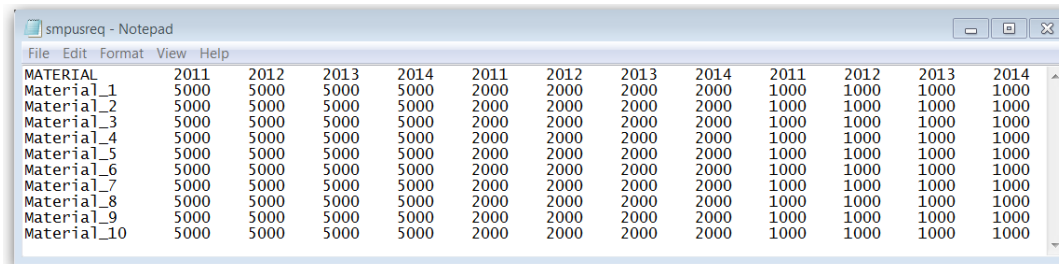
Note that all values in the example are set to one. This is done in order to create a constant delay for all countries (e.g., six months). Delay time also is affected by the cut-off ratio (found in the Case File) and the length of the scenario.

U.S. MATERIAL DEMAND INPUT FILES

Material demand must be input in order for SSM to compare it to available supply and then compute surpluses and/or shortfalls.

IDA | Input of U.S. Demand/Requirements into SSM

The file `smpusreq.txt` contains U.S. requirements figures for each material for each year for each “tier”: military demands, emergency investment demands, and civilian demands. All figures are in the units that are specified in the basic information file. Note that the scenario years in the top row are repeated three times. The first set is military demands, the second set is emergency investment demands, and the third set is civilian demands. This file is obtained from the demand computation calculation, which is external to the SSM. The first field is the material listed in alphabetical order. The subsequent columns show the U.S. demands by year and tier.



MATERIAL	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
Material_1	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_2	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_3	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_4	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_5	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_6	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_7	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_8	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_9	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000
Material_10	5000	5000	5000	5000	2000	2000	2000	2000	1000	1000	1000	1000

U.S. Requirements refers to the amount of materials required by the United States—broken down by material, year, and tier (defense, civilian, and emergency investment). In this context, the terms demand and requirements are used synonymously. This information is the result of calculating U.S. industrial base production requirements via the Forces Mobilization Model (FORCEMOB) and calculating the materials and quantities needed to support said production via the use of material consumption ratios (MCRs) and other material consumption information. These calculations constitute Steps 2-A and 2-B of RAMF-SM.

OUTPUT REPORTS

6. Output Reports

This section addresses SSM output reports.

IDA | SSM Output Reports

SSM produces a wide variety of output reports. These reports are generally self-explanatory upon use and will not be explicitly examined here.

Most output reports are in a .rpt format, which will open in either Notepad or Excel.

Note: The report “matsum,” which aggregates information from all the other output reports, is somewhat buggy and should not be relied upon. Accurate information can be obtained from the individual output report files.

Name	Date modified	Type
adjgnp.rpt	7/9/2014 2:17 PM	RPT File
carrydwn.rpt	7/9/2014 2:17 PM	RPT File
casedesc.rpt	7/9/2014 2:17 PM	RPT File
debug.rpt	7/9/2014 2:17 PM	RPT File
forprod1.rpt	7/9/2014 2:17 PM	RPT File
forprod2.rpt	7/9/2014 2:17 PM	RPT File
forprod3.rpt	7/9/2014 2:17 PM	RPT File
forsup1.rpt	7/9/2014 2:17 PM	RPT File
forsup2.rpt	7/9/2014 2:17 PM	RPT File
forsup3.rpt	7/9/2014 2:17 PM	RPT File
goalsum.rpt	7/9/2014 2:17 PM	RPT File
goalyear.rpt	7/9/2014 2:17 PM	RPT File
matsum.rpt	7/9/2014 2:17 PM	RPT File
misscnt.rpt	7/9/2014 2:17 PM	RPT File
missmat.rpt	7/9/2014 2:17 PM	RPT File
mktshare.rpt	7/9/2014 2:17 PM	RPT File
nrelass.rpt	7/9/2014 2:17 PM	RPT File
relass.rpt	7/9/2014 2:17 PM	RPT File
supdbg.txt	7/9/2014 2:17 PM	Text Docx
supdmd.rpt	7/9/2014 2:17 PM	RPT File
totglyr.rpt	7/9/2014 2:17 PM	RPT File
totgoal1.rpt	7/9/2014 2:17 PM	RPT File
totgoal2.rpt	7/9/2014 2:17 PM	RPT File
totgoal3.rpt	7/9/2014 2:17 PM	RPT File
try1118.cas	7/9/2014 2:17 PM	CAS File
try1118.log	7/9/2014 2:17 PM	Text Docx
usprod1.rpt	7/9/2014 2:17 PM	RPT File
usprod2.rpt	7/9/2014 2:17 PM	RPT File
usprod3.rpt	7/9/2014 2:17 PM	RPT File

For each SSM case, the program creates a subdirectory under the output directory and puts the output files for that case in that subdirectory. The subdirectory name is the same as the case name. Most of the SSM output reports have the suffix .rpt, but they are tab-delimited text files and are best viewed in Excel. These output reports can also be viewed in Notepad and are generally self-explanatory. The first report to view is goalsum.rpt, which has the overall shortfalls by material and tier of demand (i.e., defense shortfalls represent unsatisfied defense demand, civilian shortfalls represent unsatisfied civilian demand, and so forth). The file goalyear.rpt has shortfalls by material, tier of demand, and scenario year.

USER TIPS

7. User Tips

The next two slides outline some practical concerns and tips for using SSM.

IDA | SSM User Tips and Cautions (1 of 2)

SSM prioritizes user control. This prioritization grants a high degree of analytical power and precision but incurs a cost in terms of possible user error. The following issues should be kept in mind when running SSM:

- Filename and directory
 - SSM searches for input files by name in the directory specified by the user in the .sbf file. If the two are incongruent (e.g., the .sbf files specify C:\SSM but the files actually are stored in C:\Users\JohnSmith\MyDocuments\SSM), the program will not function properly. The same applies for output files.
 - SSM will overwrite preexisting output files in the output directory. Remember to save the results of a particular run under a different name (e.g., change matsum.rpt to matsum_run23.rpt) or in a different directory. It also is ideal to save the input files used for a particular run to keep track of what parameters were specified.
 - Filenames and pathnames cannot exceed 260 characters.

IDA | SSM User Tips and Cautions (2 of 2)

SSM prioritizes user control. This prioritization grants a high degree of analytical power and precision but incurs a cost in terms of possible user error. The following issues should be kept in mind when running SSM:

- Data inputs
 - SSM will run whatever is written in the input files. It is important to double-check all input files to ensure that there is no incongruity between what parameter values you *want* to use and what is *actually written* in the input file. SSM does not “know,” for example, the correct political reliability coding for a particular country; therefore, an unidentified error can linger. Tab-delimited text file errors are easy to spot in MS Excel.
 - SSM files must follow correct syntax and grammar. A misplaced comma, missing tab delimitation, and so forth will cause SSM to generate an error message.
- Debug and log
 - SSM automatically generates a debug file and a log file. Both files are valuable resources if SSM does not run properly and likely will point you to the file causing the error.

STUDENT TUTORIAL

8. Student Tutorial

The last three slides posit fictional scenarios for the SSM trainee to simulate. These scenarios are intended as a “hands-on” learning opportunity on operation of SSM so that the trainee will achieve a better understanding of the relationship between its inputs and outputs.

IDA | Student Exercise Tutorial 1

What if U.S. combat losses and munitions expenditures are larger than expected? Let us say that overall defense outlays will be 10% larger.

- This larger than expected expenditure means that defense regeneration needs will be higher than anticipated, thus requiring the Department of Defense (DOD) to rebuild more weapons platforms and replace larger quantities of munitions. This new requirement increases material demand by the industrial base.
- Simple implementation
 - Increase the defense material demands across the board by 10% in the SSM US Requirements input file. Rerun SSM to compute the new material shortfalls.
- N.B. This scenario ignores the macroeconomic relationships between production and industrial sector material demand.

This implementation is simple and not totally accurate because the relationship between increased defense outlays, industrial base production, and material demand involves non-linear dependencies.

In this implementation, we are positing that a 10% increase in defense spending results in exactly 10% greater defense demand for every material under study. In reality, several complications have to be considered:

- Increased defense spending also affects the civilian economy (likely increasing civilian material requirements).
- The manner in which defense spending is increased has a powerful effect on the material quantities needed to support this spending. For example, the material requirements of increased defense spending driven by regeneration of lost weapons platforms and munitions depend on the specific material requirements of the weapons to be regenerated and will almost certainly result in different material requirements than, for instance, increased defense spending driven by military health-care and personnel costs.

A more accurate examination of the impact of increased defense spending would necessitate rerunning the Interindustry Large-scale Integrated and Dynamic Model (ILIAD), the Long-term Interindustry Forecasting Tool (LIFT), and FORCEMOB with altered parameters to account for these non-linear dependencies, as detailed on the next slide.

IDA | Student Exercise Tutorial 1a

What if you wanted to account for the material/demand differences that were suggested previously?

- Practical implementation
 - Rerun the Forces Mobilization Model (FORCEMOB) with the higher specific platform losses and munitions expenditures to obtain more accurate material requirements.
 - Enter these larger and more accurate defense demands into the SSM US Requirements input file.
 - Rerun SSM.
 - Compare the results between Exercises 1 and 1a.
- If the additional loss/expenditure numbers cause greatly increased spending relative to the Future Years Defense Plan (FYDP), one might actually need to rerun the Long-term Interindustry Forecasting Tool (LIFT) and the Interindustry Large-scale Integrated and Dynamic Model (ILIAD) to account for the non-linear dependencies between material demand and expenditures.

This implementation is much more labor intensive but accounts better for the non-linear dependencies between defense spending, industrial production, and material demand.

IDA | Student Exercise Tutorial 2

What if the United States and a major supplier of critical and strategic materials become fast friends?

What happens to material shortfalls when available supplies of foreign critical and strategic materials change from U (unreliable) to R (reliable) to A (assured)?

- Practical implementation
 - Make a series of SSM runs to determine the impact of political reliability codes on material supply.
 - Use default parameters on the Case File and Method 1 under “default supply parameters” in the Case File.
 - Compare the results between all U, all R, and all A country reliability settings.
- Can foreign supplies be used to meet all demand requirements?

This slide illustrates how the SSM can be used to support exploratory analysis of the impact of larger political trends on S&CM availability. This capability is particularly useful for assessing alternate scenarios, which (per the Strategic and Critical Materials Stockpiling Act) must be included in NDS Requirements Reports.

Appendix A

Bibliography

- Santmire, Tara. “Strategic Sizing Module Documentation for Version 4.4.” IDA Paper P-2867. Alexandria, VA: Institute for Defense Analyses, 1997.
- Schwartz, Eleanor. “The 2005 National Defense Stockpile Study, Volume II: Methodological and Modeling Improvements.” IDA Draft Paper P-4442. Alexandria, VA: Institute for Defense Analyses, 2010.
- Thomason, James S., Wallice Y. Ao, Robert J. Atwell, D. Sean Barnett, Kevin E. Burns, Caroline R. Earle, Anthony C. Hermes, et al. “Analyses for the 2015 National Defense Stockpile Requirements Report to Congress on Strategic and Critical Materials.” IDA Draft Paper P-5190. Alexandria, VA: Institute for Defense Analyses, forthcoming.
- Thomason, James S., Robert J. Atwell, D. Sean Barnett, James P. Bell, Michael F. Fitzsimmons, Nicholas S. J. Karvonides, Julie C. Kelly, et al. “Strategic and Critical Materials 2013 Report on Stockpile Requirements.” IDA Paper NS P-4901. Alexandria, VA: Institute for Defense Analyses, 2013.

Appendix B

Abbreviations

CD	compact disc
DLA	Defense Logistics Agency
DOD	Department of Defense
FORCEMOB	Forces Mobilization Model
FYPD	Future Years Defense Plan
GDP	Gross Domestic Product
IC	Intelligence Community
IDA	Institute for Defense Analyses
ILIAD	Interindustry Large-scale Integrated and Dynamic Model
INFORUM	Interindustry Forecasting Project at the University of Maryland
LIFT	Long-term Interindustry Forecasting Tool
MCR	material consumption ratio
NDS	National Defense Stockpile
OSD	Office of the Secretary of Defense
OUSDP	Office of the Undersecretary of Defense for Policy
RAMF-SM	Risk Assessment and Mitigation Framework for Strategic Materials
S&CM	strategic and critical materials
SME	subject matter expert
SSM	Stockpile Sizing Module
U.S.	United States
USGS	U.S. Geological Survey

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